

# RF Exposure

## 1. IBM ThinkPad 802.11b Wireless LAN Mini-PCI Adapter

The applying equipment is a compact laptop computer which is categorized as a mobile device by FCC CFR 47 Section 2.1091. Therefore the separation distance between the antenna and the human body is 20cm or more. As shown in the following photo, the applying equipment satisfies the requirement of antenna separation.

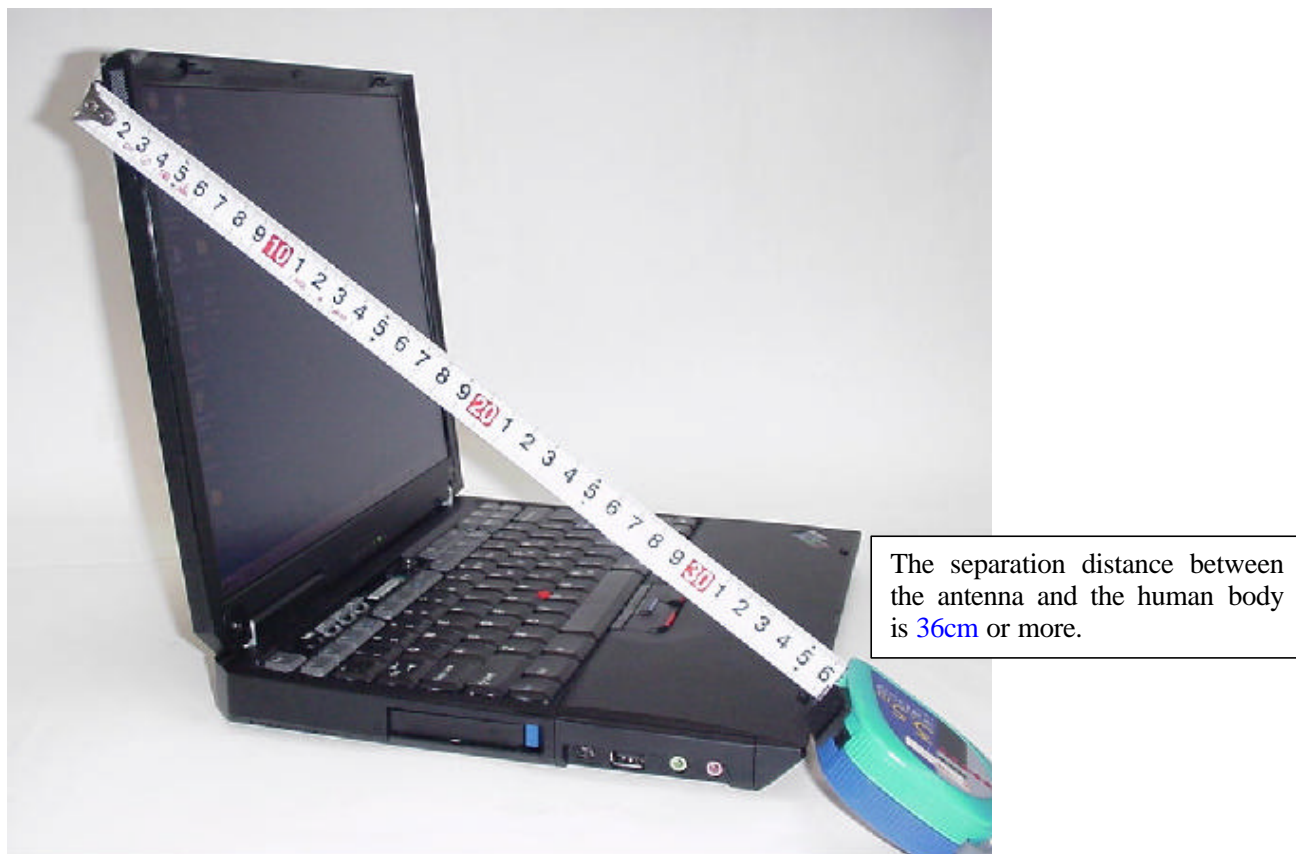


Figure 1. Integrated antenna separation from human body

The peak conducted output power of the applying equipment is 14.3dBm, and the maximum antenna gain is -0.11dBi (Dipole antenna of 13” inch model) or -1.58 dBi (Inverted F antenna of 14” inch model) as shown in Figure 2.

Therefore the maximum peak radiated output power (EIRP) is calculated as follows.

$$EIRP = P + G = 14.3 \text{ dBm} - 0.11 \text{ dBi} = 14.19 \text{ dBm} (26.24 \text{ mW})$$

Then, the maximum power density at 20cm distance is determined as follows.

$$S_1 = EIRP / (4 \times R^2 \times \pi) = 0.0053 \text{ mW/cm}^2$$

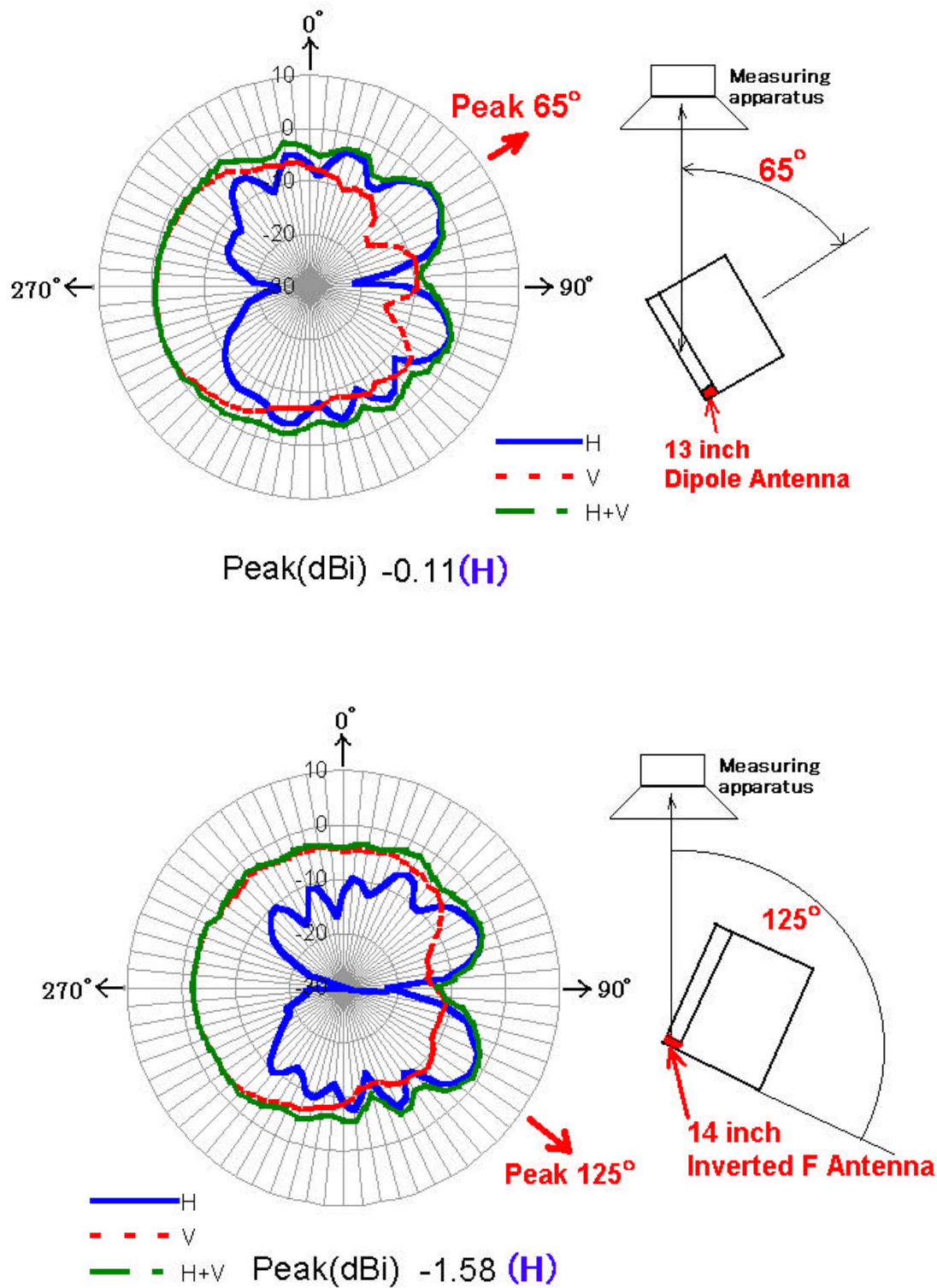


Figure 2. Transmitter Antenna Gain and Radiation Pattern

## 2. User option PCMCIA Wireless cards

The applying equipment has two interfaces to connect user’s option wireless cards. The following wireless options are used in the PC slot or USB port of the equipment.

| Interface   | FCC ID         | Grantee Name            | Product Name   | Granted Date    | EIRP in FCC test report |
|-------------|----------------|-------------------------|--|-----------------|-------------------------|
| USB port    | PI4BT-ULTRA    | TDK Systems Europe Ltd. | Bluetooth Ultraport Module                           | May/22/2001     | 1.4 mW                  |
| PCMCIA slot | O2OBTPCM101    | Degianswer A/S          | Motorola Bluetooth 0dBm PC-Card (type no.: BTPCM100) | October/18/2000 | 2.7mW                   |
|             | PI4BT-IBM-PCII | TDK Systems Europe Ltd. | Bluetooth PC Card II                                 | August/21/2001  | 1.0mW                   |

Figure 3 shows the locations of each interfaces and demonstrates that operators can maintain the necessary distance of antenna separation from the human body while normal operation.

Figure 3. Interfaces to connect Wireless options



The minimum antenna separation to satisfy the MPE limits (1mW/cm<sup>2</sup>), and the maximum power density at 20cm distance of each card are :

| Interface   | FCC ID         | EIRP  | Min. separation to satisfy the MPE limits *1 | Max. power density at 20cm *2               |
|-------------|----------------|-------|--|---|
| USB port    | PI4BT-ULTRA    | 1.4mW | 0.34cm                                       | S <sub>2</sub> = 0.00028 mW/cm <sup>2</sup> |
| PCMCIA slot | O2OBTPCM101    | 2.7mW | 0.47cm                                       | S <sub>3</sub> = 0.00054 mW/cm <sup>2</sup> |
|             | PI4BT-IBM-PCII | 1.0mW | 0.28cm                                       | S <sub>4</sub> = 0.00020 mW/cm <sup>2</sup> |

$$*1 = \sqrt{EIRP / (1mW/cm^2 \times 4 \times \pi)}$$

$$*2 = EIRP / (4 \times 20cm^2 \times \pi)$$

When an operator will use the tree transmitters simultaneously during 30 minutes continuously in normal operation, the time-averaging exposure is : (S<sub>1</sub> + S<sub>2</sub> + S<sub>3</sub>) × 30 = 0.184  
 So the source-based time-averaging duty factor is considered as 100% duty.

Therefore the applying equipment meets the MPE requirements for general Population/Uncontrolled exposure.